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ADVANTAGES OF INCREASING THE AVERAGE TURNAROUND DISTANCE OF RR FREIGHT CARS IN CHINA

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I. INTRODUCTION

In view of the importance of turnaround time, particularly in connection with its use in appraising the degree of performance of the planned transportation task, practically all the railway workers in the Northeast are deeply interested in the matter of turnaround distance. Some maintain that is is more advantageous for the turnaround distance to be short rather than long, and others hold the opposite opinion. I am one of the latter, believing that, apart from increasing the average load per freight car (the average load per freight car in the Kirin Railway Bureau is only about 20 tons), the best way to maximize the utilization of rolling stock is, on the one hand, to try to shorten the turnaround time; and, on the other hand, to try even harder to increase the average daily car-kilometrage through seeking a longer average turnaround distance. To justify my assertion I propose to discuss and refute some of the common arguments of the advocates of a shorter average turnaround distance and point out the evidence that supports my position.

II. CRITICISM OF ARGUMENTS AGAINST LONGER AVERAGE TURNAROUND DISTANCE

A. Arguments That the People's Railways Are Not Run Just for Profit, and That to Seek Longer Turnaround Distance Is Contrary to the Socialist Principle That the Proximity of Producer and Consumer is Economically Desirable

Those who advance these arguments say that long turnaround distances may be good for the railways but they are bad for the country. The weakness of this argument is that it puts the one in opposition to the other, which is bad.

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While it is entirely true that the railways are not run merely for profit, yet they must be run so as to be able to earn their cost; and to ensure this, the most advantageous methods and practices should be adopted. When the railways operate on a profitable basis, they are in a position to enlarge and improve their productive capacity to serve the country, and to make possible the general lowering of transportation costs which contributes to the economic benefit of the country.

The railways do not seek merely to carry more tonnage; they also seek longer hauls. They are content to have short-haul cargos handled by motor trucks or other means. As one way of encouraging long hauls, the railways have adopted a sliding scale of charges: beginning with a minimum of 200 kilometers, the longer the haul, the lower the rate of freight charges. In this way, the burden of heavy freight charges for long-distance shipments is lightened for the shippers. On the principle of small profits and large turnover, the railways' revenue from large ton-kilometrage is increased; their fixed costs and operating costs are more widely spread and more easily recovered.

Concerning the argument about proximity of producer and consumer, it is said that in capitalist countries, factories usually try to locate close to the source of their raw materials so as to reduce transportation costs and thus net greater profits; hence, why is it not equally advantageous for the people's economy to seek to reduce transport distances and costs?

The answer to this argument is that by such competitive practices, big strong companies crush the life out of small enterprises and limit production. In a country that has embraced the principles of the New Democracy, the concern of the government is to expand production, and to do this, it should adopt policies and create conditions whereby both large and small enterprises have equal opportunity to exist and produce. Thus shortage of haul is not the main consideration. Productive utilization of the full capacity of the railways should be the aim; not the reduction of operations to the minimum.

Planned economy makes possible the realization of a division of labor on a national scale. The Northeast produces excellent kaoliang; kaoliang produced south of the Great Wall is quite inferior. At the same time intramural China produces many things that the Northeast cannot produce. Hence the exchange of products between the various geographical areas by long-distance rail transportation is one of the great economic functions of the railways.

B. <u>Argument That if Turnaround Distance Is Increased, Turnaround Time Is Also Bound to Be Increased</u>

There is ample evidence in the monthly statistical reports supplied by the railway bureaus to show the above contention to be false. Let us see what the statistics show.

Total travel time does not increase directly in proportion to increase in turnaround distance. Many factors influence the final result, and some of them tend to neutralize each other. The following figures were supplied by the sub-bureaus of the Kirin Railway Bureau.

Months 1949	Travel Speed	Turnaround Distance	Hours in Transit	Rate of Increase in Percent: Travel Speed	Rate of Increase in Percent: Turnaround Distance	Rate of Increase in Percent: Hours in Transit
Jul	23.1	--	--	--	--	--
Aug	22.5	--	--	--	--	--
Sep	22.6	--	--	--	--	--
Oct	23.4	--	--	--	--	--
Nov	23.4	--	--	--	--	--
Dec	22.8	--	--	--	--	--
1950						
Jan	22.9	299	13	100	100	100
Feb	23.6	289	12	103	96	92
Mar	24.2	391	16	106	131	123
Apr	24.0	372	16	105	125	125
May	25.0	326	13	109	109	100

When the turnaround distance is greater, the average switching distance (SWD) is also likely to be relatively greater, and the number of switching operations are likely to be less, since many long-haul ars can be put into long-haul through trains which will average much less time in switching operations, as can be seen from the formulas which embody the definitions of the terms used. Let TKM stand for the total kilometrage; SWD for the average switching distance; TRD for the turnaround distance; and SWT for average switching time.

$$\text{SWD} = \frac{\text{TKM}}{\text{Number of cars switched}}$$

$$\text{Number of switching operations} = \frac{\text{TRD}}{\text{SWD}}$$

$$\text{Total Switching Time} = \frac{\text{TRD}}{\text{SWD}} \times \text{SWT}$$

Thus it can be seen that the greater the turnaround distance, the less the total switching time is likely to be, and this tends to lessen the turnaround time.

From one viewpoint it is thought inconsistent to advocate decrease of turnaround time and increase of turnaround distance. But it is not so. Both are important elements, and neither should be disregarded. To do so would be to make the mistake of over simplification. Later it will be shown that shorter turnaround time may accompany longer turnaround distance.

C. Argument That Longer Turnaround Distance Will Result in Greater Tightness in the Supply of Cars For Use, and in Higher Percentages of Empty Cars.

It is true that under the unevenly developed economic conditions that prevail in the various parts of the country, the number of loaded cars leaving and entering an area may not balance. This fact accounts for the return of a large number of empty cars. It is also a fact that the percentage of empty cars handled in the area of the Kirin Railway Bureau has been large, sometimes even as much as 50 percent; and the number of outgoing empty cars has also been large. This is attributable to the fact that the Northeast is still in the period of restoration and development, and the status of even exchange of commodities between areas has not yet been restored or established. Nevertheless, in the long run, the numbers of outgoing and incoming cars balance each other, which means that approximately the same numbers of cars continue to be available for operation.

The following table is based on the reports of the Kirin Railway Bureau for October 1949 to April 1950. /Figures in the following table are reproduced as given in the source document./

1949		Cars Outgoing to Other Bureaus	Cars Incoming From Other Bureaus	Percent of Incoming Cars for Each 100 Outgoing Cars
Oct	1 - 10	5,029	5,620	112
	11 - 20	5,403	4,704	87
	21 - 30	5,029	4,794	95
Nov	1 - 10	4,556	4,926	96
	11 - 21	5,080	5,170	102
	21 - 30	4,889	4,688	108
Dec	1 - 10	5,226	5,191	93
	11 - 20	4,623	4,752	103
	21 - 30	5,104	4,824	99
1950				
Jan	1 - 10	4,628	4,987	108
	11 - 20	5,251	5,102	97
	21 - 30	6,484	6,273	97
Feb	1 - 10	5,587	5,619	101
	11 - 20	6,274	6,480	103
	21 - 30	4,836	5,172	107
Mar	1 - 10	7,575	7,420	98
	11 - 20	7,666	7,653	100
	21 - 30	8,662	8,529	99
Apr	1 - 10	7,925	7,474	102
	11 - 20	7,389	7,952	108
	21 - 30	7,639	7,150	94
Average		5,928	5,916	100

Due to the system which has been adopted of the common use of cars on all lines, there is a great possibility that the distribution of cars among the lines or bureaus will adjust itself evenly, especially with the help of the unified car assignment system which is a feature of the over-all transportation plans. Hence the lack of cars due to lengthened turnaround distance is not likely to remain a problem. There need be no anxiety that because of greater average turnaround distance, this bureau would not be able to maintain its full

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quota of cars. At present, the efficiency of our railway operations is far from ideal; the average time spent by cars standing still is very great. Considering the immense size of our country, the average turnaround distance is really very small. It is needless to fear that greater turnaround distance will cause a tightness of cars for use.

For proof that turnaround distance may increase and turnaround time decrease, note the figures in the following table showing the actual operations of the Kirin Railway Bureau in 1949 and 1950.

	Turnaround Distance (km)	Turnaround Time (days)	Percentage of Empty Cars
1949			
Jul	410.7	2.33	62.4
Aug	376.1	2.25	49.8
Sep	400.0	2.02	59.1
Oct	46.1	2.09	65.5
Nov	421.0	2.12	63.6
Dec	440.1	2.15	65.2
1950			
Jan	396.0	1.95	55.4
Feb	394.0	1.77	60.2
Mar	504.0	1.96	73.5
Apr	484.0	1.89	78.7

The above records show that for March 1950, the average turnaround distance was 34 percent greater than in August 1949, while for the same periods, the turnaround time was reduced by 0.29 days, or 13 percent. In August 1949, the daily average car-kilometrage was 167 kilometers ($\frac{376.1}{2.25}$), and in March 1950 it was 257 kilometers ($\frac{504.0}{1.96}$) an increase of 54 percent. This is equivalent to saying that transportation which required 1,540 cars in August 1949, could be handled in March 1950 by only 1,000 cars.

There are two main reasons for a high percentage of empty cars to be handled. One is economic; that is, the flow of traffic is such that there is an unequal number of loaded cars moving in opposite directions. Only when the different economic regions become about equally developed can this situation be changed. Kirin is one of the areas where the percentage of empty cars is rather high. The second reason is a human one which is characteristic of the country as a whole. Inadequate planning and poor management on the part of train dispatchers and other cadres results in repeated journeys of empty cars, in empty cars being sent simultaneously in opposite directions, and other inefficiencies. This weakness can be remedied to a great extent.

Under the existing state of uneven economic development, it is natural to expect a rather high percentage of empty cars where the average turnaround distance is great. But this fact does not justify the conclusion that no advantage is gained by long turnaround distances. The advantages should be weighed against the disadvantages, and judged accordingly. Refer again to the data in the preceeding table. The turnaround distance in March 1950 was 34 percent greater than in August 1949, and the percentage of empty cars also increased, but by only 23.7 percent, (73.5 - 49.8) divided by 49.8. The attendant loss of revenue due to hauling the empty cars was comparatively small and the net result was advantageous.

Suppose the number of cars in operation in the bureau was 1,000, (converting all to the equivalent of 30-ton cars) in August 1949, the daily work load was 444.4 cars $\left(\frac{1,000}{2.25}\right)$; and in March 1950, it was 501.2 cars $\left(\frac{1,000}{1.95}\right)$.

Tonnage handled in August 1949, 444.4 x 30 = 13,332 tons

Tonnage handled in March 1950, 501.2 x 30 = 15,036 tons

Then, the number of ton-kilometers would be:

August 1949 -- 13,332 x 376.1 = 5,014,165.2 ton-kilometers

March 1950 -- 15,036 x 504.0 = 7,578,144.0 ton-kilometers

Since the revenue is proportional to the number of ton-kilometers, the revenue increase was 51.2 percent, (7,578,144 - 5,014,165.2) divided by 5,014,165.2. This rate of increase in revenue was more than twice the 23.7 percent loss in revenue occasioned by the hauling of empty cars. The 73.5 percentage of empty cars was extraordinarily high; the ordinary figure would be about 56 percent. If this latter figure were used in the calculations, the advantage of the longer turnaround distance would be even more marked. Under the planned economy policy being followed by the government, and with the prosperous expansion of commerce and industry throughout the country, it may confidently be expected that the percentage of empty cars will automatically and progressively decrease.

III. WHY TURNAROUND DISTANCE SHOULD BE INCREASED

A. To Increase Utilization of Rolling Stock

A main reason for seeking a longer average turnaround distance is to achieve a higher degree of utilization of rolling stock. There are two ways in which this can be done; (1) by increasing the average length of haul, and (2) by decreasing the amount of time spent by trains or cars in switching stations and terminals. The writer maintains that if the average turnaround distance is increased, the daily average car-kilometrage will be increased, the turnaround time will be decreased, and the degree of utilization of cars will be higher. To see if this reasoning is correct, suppose that a certain bureau supplied the following data.

Number of cars loaded	300
Number of cars unloaded	270
Number of loaded cars handled	490
Average travel speed	27 kilometers per hour
Average switching time	3 hours

Average stopping time	16 hours
Turnaround distance	389 kilometers
Average switching distance	150 kilometers

Applying these figures in the basic time-count formula, we have:

$$TRT = 1/24 \left(\frac{389}{27} + \frac{389}{150} \times 3 + \frac{300 + 270}{490} \times 16\right) = 1.7 \text{ days}$$

Under the Soviet system of switching and marshalling trains which is now being used in China, the turnaround distance and the average switching distance bear a direct relationship to each other; when the former is increased, the latter also is increased. Goods destined for distant places can be marshalled into through freight trains that require a minimum of stops for switching purposes. With fewer switching stops, the average switching distance is greater.

Now, suppose the turnaround distance is doubled and becomes 778 kilometers. Also assume that the number of switchings is reduced by one third, an assumption that cannot be challenged in view of the average distance between switching stations on the lines in the Northeast and assume that the other figures remain the same. Then the turnaround time will be:

$$TRT = 1/24 \left(\frac{778}{27} + \left(2 \times \frac{389}{150}\right)\left(1 - \frac{1}{3}\right) \times 3 + \frac{300 + 270}{490} \times 16\right) = 2.4 \text{ days}$$

Compare the two results.

When the turnaround distance was 389 kilometers, the turnaround time was 1.7 days. When the turnaround distance was doubled, it may be said that the turnover of the cars was speeded up, or that one day was saved in the turnaround time; thus

$$2 \times 1.7 - 2.4 = 1 \text{ day}$$

This represents a saving of 58.8 percent, (1 divided by 1.7 = 0.588).

When the turnaround distance was 389 kilometers, the average daily kilometrage was 228.8 (389 divided by 1.7). When the turnaround distance was doubled, the average daily kilometrage was raised to 324.2 kilometers (778 divided by 2.4). In other words, the degree of car utilization was increased 41.7 percent, (324.2 - 228.8) divided by 228.8. This means that if the turnaround distance is doubled, 1,000 cars could do the work of 1,417 cars operating on the short turnaround distance basis, or that the same amount of work could be done by 583 cars instead of 1,000 cars. By saving 417 cars, a larger number of trains could be put into operation. According to the figures of the Kirin Railway Bureau for the last half of 1949, the average number of cars per train was 25.

Kirin Railway Bureau Data for 1949

Month	Av No of Cars per Train
Jul	25
Aug	26
Sep	24
Oct	25
Nov	26
Dec	25
Average	25

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It can be seen that to judge correctly the degree of accomplishment, it is not sufficient merely to see if the turnaround time has been reduced. It should be noted whether or not the turnaround distance has increased or decreased. If it has increased and the planned task has been completed, then it must be acknowledged that the record of accomplishment in the use of rolling stock has been a good one even though the turnaround time may have been a little high.

B. To Reduce Congestion of Cars at Switching Stations

Since the number of tracks at switching stations are limited, the presence of too many cars at the same time and place is the principal cause of delays in switching. For the period from July to December 1949, at all the switching stations under the Kirin Railway Bureau of the total number of cars that were switched, 110,688 cars required more than the standard average switching time. Of these switching delays, 11.3 percent were attributable to congestion in the switching yards. The situation was much worse in winter than at other times as shown below:

Kirin Railway Bureau -- Switching Delays

1949 Month	Delays Due to Congestion	Total No of Cars delayed	Percentage Due to Congestion
Jul	827	19,451	4.3
Aug	1,057	18,130	5.8
Sep	1,505	18,472	8.1
Oct	2,157	19,391	11.1
Nov	3,561	19,788	18.0
Dec	3,398	15,456	22.0
Total	12,505	110,688	11.3 (average)

There are several ways to avoid trouble from crowding at switching stations, but it is considered that the most effective is to decrease the number of cars to be switched. To do this, in the marshalling yards, the cars should be classified according to destination, and, as far as possible, made up into through freight trains that will stop for switching a minimum number of times. Under present conditions in the Northeast, this is not a difficult matter.

It would be well for the Chinese railway men to note the Soviet practice in this regard. They classify their freight trains into three main categories as follows.

1. Limited Direct Through Freight Trains

These are trains made up of cars all of which have the same station of origin and the same destination. These trains require no switching.

2. Ladder-Type Direct Through Freight Trains

These trains are made up of cars all of which have the same destination, but are picked up from more than one station of origin en route. These trains also require no switching.

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3. Blocked Through Freight Trains

These trains are made up of blocks, or groups, of cars arranged according to destination. The first block should include those cars whose destination lies beyond the first switching station en route but not as far as the second switching station. This block would be dropped at the first switching station and would have to be switched only once. The second block would consist of cars whose destination is beyond the second switching station but not as far as the third switching station. This block would be dropped at the second switching station and would have to be switched only once. And similarly with the other blocks. If rightly handled according to this method, no cars would have to be switched more than once, even though some of them might pass through two or more switching stations. The total number of cars to be switched would be substantially reduced, and the total switching time greatly shortened.

The men whose duty it is to make up the trains should be encouraged to put these methods into practice and thus help to derive the benefits to be gained from long turnaround distances.

C. To Reduce Operating Costs

By skillful arrangement of cars when making up trains, by forming more through freight trains and fewer trains that have to be rearranged en route, even when the average turnaround distance is great, the operations are simplified, the working time of trainmen and yardmen is shortened, and other operating costs may be substantially reduced.

In large busy switching terminals, the addition of even a small number of cars to be switched may require the addition of another switching engine and engine crew, which would mean additional expense. For example, one hour's operation of a switching engine is equivalent to 9 locomotive-kilometers. According to 1949 figures, one locomotive-kilometer required 30 kilograms of coal, add to this the cost of lubricating oil, etc., and the whole cost is by no means insignificant. When the conditions in train yards are not tight, and more trains can pass through without interruption and delays, manpower savings can be effected and not only will switching costs be reduced, but the over-all efficiency of rail transportation will be raised.

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